

REMARKS

Claims 1–19 are currently pending in the application. In an Office Action dated May 14, 2004 (“Office Action”), the Examiner rejected claims 1, 2, and 19 under 35 U.S.C. § 102(e) as being anticipated by Hockaday et al., U.S. Patent No. 6,630,266 B2 (“Hockaday”), rejected claims 6 and 7 under 35 U.S.C. § 103(a) as being unpatentable over Hockaday in view of Vieira et al., U.S. Patent No. 5,098,477 (“Vieira”), rejected claims 10 and 11 under 35 U.S.C. § 103(a) as being unpatentable over Hockaday and Vieira in view of Bauer, U.S. Patent No. 4,523,852 (“Bauer”), rejected claims 12–15 under 35 U.S.C. § 103(a) as being unpatentable over Hockaday and Vieira and in further view of Bauer, U.S. Patent No. 4,523,852 (“Bauer”), and rejected claims 8 and 9 under 35 U.S.C. § 103(a) as being unpatentable over Hockaday in view of Beecher et al., U.S. Patent No. 5,192,984 (“Beecher”). The Examiner objected to claims 3–5 and 16–18 as being dependent on a rejected base claim, but indicated that these claims would be allowable if rewritten in independent form.

Applicant's representative would like to thank the Examiner for the conditional allowance of claims 3–5 and 16–18, and will consider rewriting them in a future response. In the current response, Applicant's representative respectfully traverses the 35 U.S.C. § 102(e) and 35 U.S.C. § 103(a) rejections, for reasons provided below.

All of the Examiner's claim rejections are based either solely on Hockaday or rely on Hockaday. However, in Applicant's representative's opinion, the Examiner has not appreciated fundamental differences between Hockaday's disclosed fuel ampoules and fuel *level* indication system and Applicant's claimed fuel-*concentration* indicator.

Hockaday clearly and repeatedly states, in Hockaday's specification, that the disclosed fuel ampoules function by selective permeability of the ampoule walls. They are permeable to methanol, but not to water. Hence, as fuel is consumed, the volume of liquid within the fuel ampoule decreases, much as the volume of liquid fuel decreases in the gas tank of an automobile between refuelings. For example, Hockaday states, beginning on line 14 of column 3:

By having a selectively permeable fuel tank wall, such as silicone rubber, the fuel delivery has the advantageous effect of delivering fuel at a constant rate throughout its life cycle. If the membrane had similar permeability to fuel compared to water, the water

would be diffusing in while the fuel was diffusing out.

Similarly, beginning on line 6 of column 5, Hockaday states:

The thickness of the silicone rubber may be chosen to deliver fuel at a rate needed by the fuel cells. The silicone rubber diffuses methanol out at a rate approximately 35 times that of water diffusing in. Thus, the selective permeability means that the methanol diffuses out while little water diffuses in. This feature keeps the vapor pressure of methanol in the ampoule constant throughout the use of the ampoule fuel which in turn keeps fuel delivery constant.

Note that vapor pressure of methanol is directly related to the concentration of methanol in a methanol/water solution. The fact that the vapor pressure of methanol remains constant implies that the concentration of methanol in the methanol/water solution in the fuel ampoule also remains constant. Understanding that Hockaday's fuel ampoules allow methanol to seep out to the fuel cell, but do not allow much water in, illuminates the passage of Hockaday cited by the Examiner, beginning online 51:

The fuel may have colored dyes so that as the fuel is used it will give a color change indication of fuel status since the remaining fuel will be darker.

In other words, as the volume of fuel in the fuel ampoule decreases, the *dye* will become more concentrated, and will appear darker. Hockaday's dye is not responsive to fuel concentration. A dye responsive to fuel concentration would not have any purpose in Hockaday's fuel ampoule, because the fuel concentration does not appreciably change – only the volume of the fuel solution changes.

By contrast, Applicant's fuel-concentration indicator and method for determining fuel concentration, clearly claimed in claims 1 and 12, below, use a dye responsive to methanol concentration:

1. A fuel-concentration indicator incorporated in a fuel cell that operates by oxidizing a fuel solution, the fuel-concentration indicator comprising:
a volume of the fuel solution; and
a dye mixture responsive to fuel concentration within the volume of the fuel solution.

12. (original) A method for determining the concentration of fuel in a fuel solution in a fuel cell having an anode reservoir, the method comprising:
adding a dye combination to the fuel solution contained in the anode reservoir; and

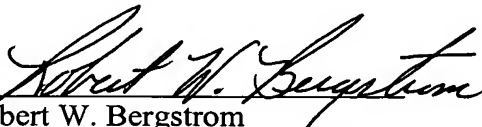
determining the concentration of fuel in the fuel solution by comparing the color of the fuel solution containing the added dye mixture to standard colors displayed on a color gradient.

Operation of Applicant's fuel cell is clearly described in paragraph 18 on page 4 of Applicant's specification. Fuel concentration decreases during operation of the fuel cell, indicated by a change in color of a fuel-concentration-responsive dye.

In other words, while Hockaday's fuel ampoules are nearly-constant-fuel-concentration but variable-fuel-solution-volume reservoirs, Applicant's fuel cell employ a nearly-constant-fuel-solution-volume but variable-fuel-concentration reservoir. Hockaday's fuel solution becomes darker as dye is concentrated by decreasing fuel-solution volume, while, by contrast, Applicant's fuel-concentration-responsive dye changes color due to a change in fuel concentration. Hockaday's dye is not disclosed as being responsive to fuel concentration, nor would a concentration responsiveness provide any benefit, as discussed above. As clearly claimed in claim 1, provided above, Applicant's dye is responsive to fuel concentration, and as clearly claimed in claim 12, above, Applicant's method determines the fuel concentration, not the volume of fuel solution. Hockaday is unrelated art, and nether anticipates nor makes obvious Applicant's claimed invention.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

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